Geometry of chaos in the two-center problem in General Relativity

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Abstract

The two center problem in General Relativity is the problem of geodesic motion in the two black-hole spacetime defined by the Majumdar-Papapetrou solution of the Einstein - Maxwell equations; an exact solution which describes, in general, N static maximally charged black holes balanced under mutual gravitational and electrostatic interaction. Recently it's been discovered by Cantopoulos through numerical experiments that null geodesic motion on the two black-hole spacetime exhibits chaotic behavior. We attempt to identify the geometric sources of this chaotic dynamics by first reducing the problem to that of geodesic motion on a negatively curved (Riemannian) surface.